Centers for Learning & Teaching: Renewing Leadership Capacity

Richard A. Duschl

King's College London

PI - Center for Informal Learning and Schools (CILS); Partners w/**The Exploratorium** (Rob Semper); **UC-Santa Cruz** (Joyce Justice, Lynda Goff)

The Word on the Street, or The Story as I Know It

- Congressional interest to explain the economic boom of the 80's
  - Alan Greenspan - investment during the 1960s and 1970s by NSF in human capital
- NSF Program Officers wondering now that we are beginning to get a scientific understanding of teaching and learning, who will carry us forward in the next generation?

Existing CLTs

- **Round 1 -**
  - Technology - Texas A&M;
  - Middle School Maths - Delaware, Maryland, Penn State
- **Round 2 -**
  - Informal Learning & Schools; King's, Santa Cruz, Exploratorium
  - Assessment - Far West Lab, UCLA, Stanford, UC-Berkeley
  - Diversity in Math Education - Wisconsin, Berkeley,
  - Distance Learning - Montana St., Portland St.& Others
  - Rural Math Education - Tennessee, Ohio, Kentucky

Existing CTLs cont.

- ⌘ Round 3 -
  - Materials Development in Science - Michigan, Michigan St., Northwestern, AAAS;
  - Inquiry & Teacher Preparation - Washington University, St. Louis Science Center, Missouri Botanical Gardens
  - MS Math Teacher Subject Matter Preparation - Michigan, Georgia
- ⌘ Round 4 -
  - Technology - Berkeley, Concord & Others
  - K-12 Math Curriculum Development - Missouri & Others
  - Mathematics - Rutgers & Others

CLT Partnership Challenges

- ⌘ Within
  - ⌃ Leadership
  - ⌃ Recruitment
    - ☒ Staff & Students
  - ⌃ Communication
  - ⌃ Research Agenda
    - ☒ Center's vs. Individual's
  - ⌃ Research Partners
    - ☒ London Zoo, Science Museum, Natural History Museum

- ⌘ Between
  - ⌃ Research Partnerships with other CTLs (annual meetings)
  - ⌃ Research Partnerships with other NSF initiatives; e.g., MSPs, Germany, etc.
  - ⌃ Cultures of Inquiry
    - ☒ Psychology, Education, Sciences. Museums.

CILS Goals

⌘ **Leadership Development Goals**
  - 24-30 Ph.D. Students
  - 12 Post docs
    - ⊠ UCSC/Science Fellows
    - ⊠ Exp/Museum Fellows
  - 100+ Masters Students
  - Place CILS participants in university posts and in "science center" posts.

⌘ **Research Goals**
  - Establish a research agenda on science learning and teaching that bridges two worlds
  - Further our understanding of how to mediate learning
  - Seek to inform cognitive and social psychological models of learning
  - Id. factors/practices that improve T & L

The Learning Sciences

- Bransford, J., Brown, A. & Cocking, R. (Eds.). (1999). *How People Learn: Brain, mind, experience and school*. Washington, DC: National Academy Press.

- Pellegrino, J., Chudowsky, N. & Glaser, R. (Eds.). (2001). *Knowing what student know: The science and design of educational assessment.* Washington, DC: National Academy Press.

- NRC. (2000). *Inquiry and the National Science Education Standards*. Washington, DC: National Academy Press.

http://www.nap.edu

Learning How to Learn

- Advances in communication technology and in our understanding of:
  - Reasoning and scientific reasoning
  - The structure of knowledge and scientific knowledge
  - The processes associated with knowledge growth and development
- New Ways of 'Seeing' Classrooms

3 Ps

- **Psychology - Learning**
  - Cognitive Science, Information-processing, social psychology, activity theory
- **Philosophy - Knowledge**
  - Epistemology; Science Studies; Models, Argumentation; (*ETHICS)*
- **Pedagogy - Teaching**
  - Inquiry Learning; Problem-based Learning; Community of Learners; Model-based Learning; Design Principles

Cognitive & Social Psychology

- **Structured Knowledge**
  - Instruction should develop conceptual structures to support inference & reasoning
- **Prior Knowledge**
  - Learner intuition is a source of cognitive ability that supports & promotes new learning
- **Metacognition**
  - Reflecting on learning, meaning making & reasoning strategies provide learners a sense of agency.
- **Procedural Knowledge in Meaningful Contexts**
  - Learning information should be connected with its use

Cog. & Soc. Psych. (cont.)

⌘ **Social participation and cognition**

⌃ Social display of cognitive competence via group dialog helps individuals acquire knowledge and skill.

⌘ **Holistic Situation for Learning:**

⌃ Competence is best developed through cognitive apprenticeship within larger task contexts.

⌘ **Make Thinking Overt**

⌃ Design situations in which the thinking of the learner is made apparent and overt to the teacher and to students. (from, Glaser, 1994)

Nanotechnology Engineering & Education

- Intuitions on Success:
  - Will emerge from design-based learning programs - science & maths in context
  - Will emerge from mathematics more than from science -abstractions of space & time
  - Will emerge from development of spatial and model-based reasoning
  - Will emerge from an emphasis on **how** we came to know and **why** we believe and NOT on **what** we know - i.e., *The Learning Trajectory*.